CLAIMS

We claim:

1. A monolithic integrated 3-axis accelerometer chip, comprising:

a single crystal substrate, said single crystal substrate including at least one single crystal membrane layer portion, and

a single sensor microstructure formed using said membrane layer, said sensor microstructure capacitively sensing acceleration in all three orthogonal axes.

2. The accelerometer of claim 1, further comprising at least one electronic circuit formed on said on said chip, said electronic circuit communicably connected to said accelerometer.

3. The accelerometer of claim 1, wherein said electronic circuit includes at least one selected from the group consisting of a pre-amplifier, a demodulator, a low-pass filter, an A/D converter and a DSP.

4. The accelerometer of claim 1, wherein all components comprising said sensor microstructure utilize said membrane layer.

5. The accelerometer of claim 1, wherein said sensor microstructure comprises a plurality of comb finger sets including at least one comb finger set for motion sensing in each of said three orthogonal axes.

6. The accelerometer of claim 5, wherein said plurality of comb finger sets provides fully differential capacitive bridges for both x-sensing and y-sensing.

7. The accelerometer of claim 1, wherein said plurality of comb finger sets comprise a metal/dielectric composite thin film layer stack disposed on said membrane layer.

8. The accelerometer of claim 7, wherein said membrane layer beneath respective ones of said comb finger sets are electrically isolated from one another.

9. The accelerometer of claim 1, wherein said accelerometer includes a rigid frame disposed between structure for x-y sensing and structure for z sensing for decoupling x-y sensing from z-sensing.

10. The accelerometer of claim 9, wherein said structure for z-sensing is disposed inside said rigid frame, wherein said frame together with said z-sensing structure is an effective proof mass for said structure for x-y sensing.

11. The accelerometer of claim 9, wherein said structure for x-y sensing is disposed inside said frame, wherein said frame plus said x-y sensing structure is an effective proof mass for said z-sensing structure.

12. The accelerometer of claim 1, wherein said accelerometer includes structure for differential capacitive sensing in at least one of said three orthogonal axes.

13. The accelerometer of claim 1, wherein said accelerometer includes structure for differential capacitive sensing in all three of said orthogonal axes.

14. The accelerometer of claim 12, wherein said structure for differential capacitive sensing comprises a rotor disposed between two stators, said rotors and said stators formed from a metal/dielectric stack disposed on said membrane layer.

15. The accelerometer of claim 14, wherein said metal in said metal/dielectric stack portions are electrically isolated from said membrane layer.

16. The accelerometer of claim 14, wherein said metal in said metal/dielectric stacks is electrically connected to said membrane layer, said membrane layer comprising an electrode of said structure for differential capacitive sensing.

17. The accelerometer of claim 14, wherein said metal in said metal/dielectric stack is disposed in sidewalls of said metal/dielectric stack.

18. The accelerometer of claim 14, wherein a cross sectional area of said membrane layer is less than a cross sectional area of said metal/dielectric stack.

19. The accelerometer of claim 18, wherein a cross sectional area of said membrane layer proximate to an interface with said metal/dielectric stack is less than a nominal cross sectional area of said membrane layer.

20. The accelerometer of claim 1, wherein said membrane layer is less than 100 μm thick.